An isothermal calorimeter that simultaneously measures at four temperatures

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Isothermal (heat conduction) calorimeters measure thermal power (heat production rate) \( P \) (W), which is proportional to the rate of the process being studied. It is thus an interesting method for studying kinetics of processes. This is especially true for slow processes with time-scales from hours to years. As measurements can be performed at different (constant) temperatures, it is also possible to evaluate activation energies (or other measures of the influence of temperature). However, a practical limitation for most laboratories is that such measurements are quite time consuming as the measurements have to be repeated at different temperatures. A study of a process that takes a week, will for example take a month or more, if one wants to get data at 3-4 temperatures.

To improve the situation, I have developed an isothermal (heat conduction) calorimeter that simultaneously measures the thermal power at four different temperatures on samples in 4 mL vials. The figure shows the result from a measurement with calcium sulfate hemihydrates hydration. Biological examples are given in the reference.

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\text{Gypsum hydration} \\
\text{CaSO}_4 \cdot 0.5\text{H}_2\text{O} \rightarrow \text{Ca}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{CaSO}_4 \cdot 2\text{H}_2\text{O}
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Status: ongoing

Duration: started 2005 (continuous)
